RIEGL VMQ®-3HA

Use the latest advancements in *RIEGL* LiDAR Technology for your mobile applications:

3 MHz effective measurement rate
400 scan lines/sec scan speed



The *RIEGL* VMQ-3HA is a compact, economically priced High-Speed Single Scanner Mapping System, well suited for a variety of mobile mapping applications.

The system consists of a compact measuring head with a quick release system for convenient mounting. A swivel plate enables multiple mounting angles in order to optimize the field of view of the system. The optional integration of up to four cameras allows simultaneous acquisition of imagery to complement the captured LiDAR data.

The central part of the system is the fully integrated VUX-3HA LiDAR sensor providing 3 mio. measurements and up to 400 scan lines per second for an outstanding performance in mobile applications.



High Speed Single Scanner Mobile Mapping System

Typical Applications

• Transportation Infrastructure Mapping • Road Surface Measurement • HD Mapping for Autonomous Vehicles • City Modeling • Rapid Capture of Construction Sites and Bulk Material • GIS Mapping and Asset Management • As-Built Surveying • Open Pit Mine Surveying

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Key Features

• *RIEGL* High-Performance LiDAR Sensor for Mobile Mapping

Core component of the *RIEGL* VMQ-3HA is the **kinematic LiDAR Sensor VUX-3HA**. The high-accuracy, high-speed laser scanner offers a maximum effective measurement rate of up to 3 MHz, 3 mm accuracy, 2 mm precision, a scan speed of 400 scan lines/sec, and a 360 degree "full circle" field of view.

Fully integrated into the measuring head of the VMQ-3HA, the sensor enables acquisition of dense point cloud patterns even with single passes at common traffic speeds.



***RIEGL* VUX-3HA**
high-performance kinematic LiDAR sensor

VMQ-3HA Scan Pattern

3 MHz			3 m distance			10 m distance			50 m distance		
platform speed	line spacing @ 250 lps [mm]	line spacing @ 400 lps [mm]	point spacing @ 250 lps[mm]	point spacing @ 400 lps[mm]	pts/m²	point spacing @ 250 lps [mm]	point spacing @ 400 lps [mm]	pts/m²	point spacing @ 250 lps [mm]	point spacing @ 400 lps [mm]	pts/m²
50 km/h	56	35	1.6	2.5	11450	5.2	8.4	3430	26.2	41.9	680
80 km/h	59	56	1.6	2.5	7160	5.2	8.4	2145	26.2	41.9	425
100 km/h	111	69	1.6	2.5	5730	5.2	8.4	1715	26.2	41.9	340
120 km/h	133	83	1.6	2.5	4775	5.2	8.4	1430	26.2	41.9	285

• System Operation

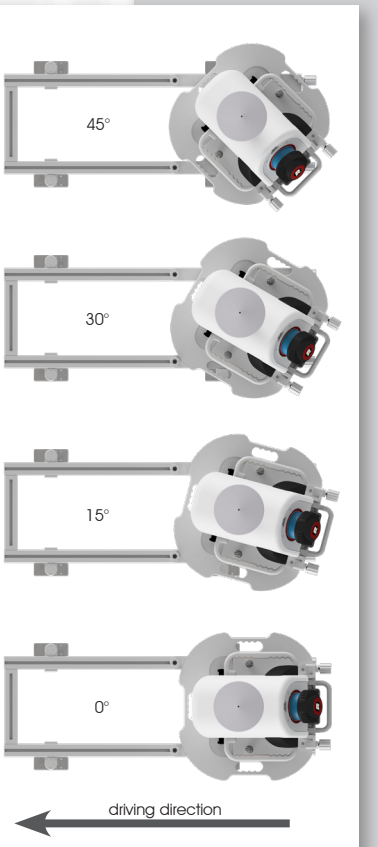
By means of the swivel plate the measuring head can be set to seven different pre-defined mounting angles (-45° to +45° in 15° increments). This flexible system configuration allows the generation of different point cloud patterns meeting diverse project requirements and improving the scan pattern especially for multi-pass applications.

The VMQ-3HA is powered via the VM Power Supply Box. It provides power for the VMQ-MH Measuring Head, the DMI, and either for the VM-IU Interface Unit, or a data acquisition laptop. The VM Power Supply Box enables failsafe operation by redundant power input from the vehicles on-board power supply and a backup battery. The VM-IU is a compact data acquisition unit for convenient system operation. It provides extended disk space to store scan data as well as camera data.

Optionally the system can also be operated with a user laptop instead of the VM-IU, if no *RIEGL* cameras are used.

RIEGL MLS Systems
Camera Options

Explore the full range of camera options available for integration with the VMQ-3HA!



multiple swivel positions

• Seamless *RIEGL* Workflow

The *RIEGL* data acquisition software facilitates the operator's task in the field by providing real-time visualization of acquired scan data and imagery. The *RIEGL* software packages also offer comprehensive features in data processing. This covers enhanced scan data adjustment to merge overlapping mobile scan data. Furthermore it enables the scan data to be fitted to specific control objects which results in a consistent point cloud of enhanced precision and increased geo-referenced accuracy.

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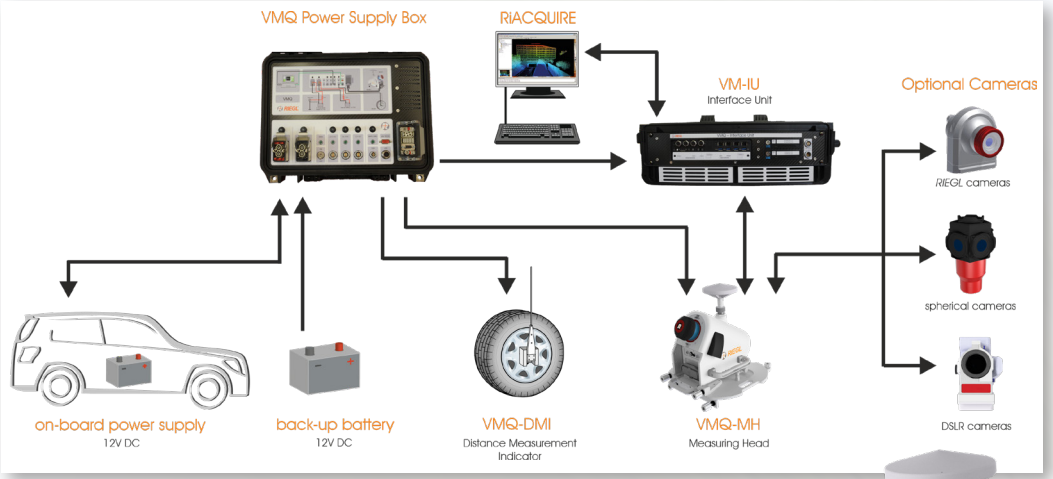
RIEGL VMQ-3HA System Block Diagram



RIEGL VMQ-3HA System Components:

- *RIEGL* VMQ-MH Measuring Head
- *RIEGL* VM-IU Interface Unit
- *RIEGL* VM Power Supply Box
- VM-DMI Distance Measurement Indicator
- up to 4 cameras (optional)
- sustainable power supply with back-up battery
- connecting cables

RIEGL VMQ-3HA Setup and Components



Physical Data	Main Dimensions (L x W x H)	Weight (approx.)
VMQ-MH Measuring Head	496 x 387 x 507 mm	17.7 kg
VMQ-RM Roof Mount		
Mounting Frame	1149 x 440 x 110 mm	9 kg
Swivel Plate	568 x 514 x 70 mm	13 kg
VM Power Supply Box	415 x 330 x 175 mm	7.8 kg
VM-IU Interface Unit	550 x 353 x 230 mm	14.8 kg
VMQ-MC Main Cable	standard length 5 m	8 kg

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RIEGL VMQ-3HA Technical Data



max. measurement range



pulse repetition rate (peak)


online waveform processing



optional digital camera


multiple target capability


eye safe operation at Laser Class 1

VMQ-3HA Scanner Performance

Laser Class	Laser Class 1 (Class 1 Laser Product according to IEC 60825-1:2014)			
Effective Measurement Rate [1) 2)]	300 kHz	1000 kHz	1800 kHz	3000 kHz
Max. Range, Target Reflectivity ρ ≥ 80% [3) 4)]	500 m	280 m	250 m	200 m
Max. Range, Target Reflectivity ρ ≥ 10% [3) 4)]	180 m	100 m	90 m	70 m
Max. Number of Targets per Pulse [5)]	31	15	8	5
Minimum Range	1 m			
Accuracy [6) 7)] / **Precision** [7) 8)]	3 mm / 2 mm			
Field of View	360° "full circle"			
Scan Speed (selectable)	up to 400 scans/sec			

1) Rounded values, selectable by measurement program.
2) Setting of intermediate PRR values possible.
3) Typical values for average conditions. Maximum range is specified for flat targets with size in excess of the laser beam diameter, perpendicular angle of incidence, and for atmospheric visibility of 23 km. In bright sunlight, the max. range is shorter than under overcast sky.
4) Ambiguity to be resolved by post-processing with RiUNITE software.
5) If more than one target is hit, the total laser transmitter power is split and, accordingly, the achieveable range is reduced.
6) Accuracy is the degree of conformity of a measured quantity to its actual (true) value.
7) One sigma @ 30 m range under *RIEGL* test conditions.
8) Precision, also called reproducibility or repeatability, is the degree to which further measurements show the same result.

IMU/GNSS Performance	AP+30	AP+50	AP+60	*RIEGL* RiLOC-F [11) 12)]
Position Accuracy Horizontal **Position Accuracy Vertical**	typ. 0.02 m typ. 0.03 m	typ. 0.02 m typ. 0.03 m	typ. 0.02 m typ. 0.03 m	typ. 0.02 m typ. 0.03 m
Roll & Pitch Accuracy	0.010° [9)]	0.005° [9)]	0.0025° [9)]	0.005°
Heading Accuracy	0.025° [9) 10)]	0.015° [9) 10)]	0.015° [9)]	0.020°

9) Absolute accuracy specifications (RMS). Typical performance. Actual results are dependent upon satellite configuration, atmospheric conditions, and other environmental effects. Post processed using base station data. No GNSS outage, with DMI option.
10) Improved heading accuracy with dual antenna option @ 2 m base line.
11) *RIEGL* RiLOC-F IMU/GNSS System with RiLOC-CU-26
12) Typical accuracy under ideal conditions, RMS values, no GNSS outages, short baseline < 10km. Positioning performance depends on satellite visibility, atmospheric conditions, and other environmental effects. Navigation performance depends on vehicle dynamics.

RIEGL RiLOC®-F (Localization/Orientation Component) Additional Data

IMU Sampling Rate	more than 700 Hz
IMU Acceleration Range	± 8 g
IMU Angular Rate Range	± 300°/sec
GNSS System	multi-constellations (GPS, GLONASS, Galileo, and BeiDou) up to triple-frequency
IMU/GNSS/LiDAR Performance RiLOC-F [13)]	
3D Point Accuracy / 3D Point Precision	0.02 - 0.03 m / 0.01- 0.02 m

13) Typical accuracy/precision (1 sigma @ 50 m range) after integrated georeferencing, under *RIEGL* test conditions. Accuracy depends on GNSS positioning, above caveats apply (short baseline < 10km, no GNSS outages). Overlapping scan data, varied environment geometry and/or man-made objects with planar features are required. Recommended maximum mission duration: 4 h

General Technical Data

Power Supply Input Voltage	11 - 15 V DC
Power Consumption	typ. 160 W (max. 220 W) [14)]
Temperature Range	-20°C [15)] up to +40°C (operation) / -20°C up to +50°C (storage)
Humidity	max 80% non condensing @+31°C

14) with 2 x 12 MP *RIEGL* camera
15) Requires that the scanner is powered up at or above -10 °C ambient temperature and held in continuous scanning operation. Insulating the scanner with appropriate material will enable operation at even lower temperatures.

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Interfaces

Interfaces Measuring Head (VMQ-MH)	**VM Power Supply Box**	**Interface Unit** (VM-IU)
4x trigger pulse, exposure pulse, NMEA data (e.g. for optional cameras or additional devices) 1x PPS out pulse for synchronization of additional device 2x LAN, 1000 Mbit/sec for data transfer to control unit of external devices (e.g. image data acquisition) 1x secondary antenna connector for GPS azimuth measurement subsystem	1x DMI input (for distance measuring indicator; odometer) 1x NAV RS-232 (COM port for IMU/GNSS for RTK, SBAS) 3x power supply socket (2x 24 V DC / 1x 12 V DC)	4x LAN 1Gbit/sec M12 sockets, 3 ports pre-configured 4x LAN 1Gbit/sec RJ45 sockets, 2 ports pre-configured 4x USB 3.1 (e.g. image data transfer from a spherical camera) 1x display port 1x WLAN (integrated antenna) 1x Bluetooth (integrated antenna) 2x slots for removable hard disk 1x power supply input (+24 V DC) 1x power supply output (+24 V DC) for display (touchscreen)

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